

Listing of Claims:

1. (Currently amended) A method in a computer system for individualizing a heartbeat signal for use as a biometric marker comprising the steps of:

acquiring a plurality of electronic heartbeat signals from an individual in an electronic signal form using an optical sensor;

for each electronic heartbeat signal, measuring, a plurality of pre-selected heartbeat waveform features to generate corresponding measurements;

weighting the pre-selected heartbeat waveform features ~~to provide~~;

providing a different statistical weight for each pre-selected heartbeat waveform feature;
and

authenticating an individual based on the weighted pre-selected heartbeat waveform features.

2. (Currently amended) A computer readable storage medium containing instructions for controlling a computer system to perform a method to individualize a heartbeat electronic signal for use in biometric authentication, the method comprising:

acquiring a plurality of electronic heartbeat signals from an individual in an electronic signal form using an optical sensor;

for each electronic heartbeat signal, measuring one or more pre-selected heartbeat waveform features to generate corresponding measurements;

weighing the pre-selected heartbeat waveform features ~~to provide~~;

providing a different statistical weight for each of the one or more pre-selected heartbeat waveform features; and

authenticating a user using said weighed pre-selected heartbeat waveform features.

3. (Previously presented) The computer readable storage medium of claim 2 where said measurements are made on only one heartbeat waveform feature per acquisition.

4. (Previously presented) The computer readable storage medium of claim 2 where said measurements are made on two heartbeat waveform features per acquisition.

5. (Previously presented) The computer readable storage medium of claim 2 where said measurements are made on a plurality of heartbeat waveform features per acquisition.

6. (Withdrawn) A method for individualizing heartbeat waveform comprising the steps of:

capturing and recording a number of heartbeat waveforms;
extracting particular univariate and multivariate features from the waveforms;
individualizing measurements of the univariate and bivariate features of the waveform;
and
calculating probabilities for measurements of the univariate and bivariate features.

7. (Withdrawn) The method of claim 6 wherein the step of individualizing further comprises the steps of:

subtracting each univariate measurement from the average value of the univariate measurement to yield a centroid;
dividing each centroid by the standard deviation of the univariate feature to yield a quotient;
determining the probability of the quotient using a distribution calculation; and
selecting a threshold minimum probability.

8. (Previously presented) The method of claim 1 further comprising:
for each electronic heartbeat signal, measuring an additional pre-selected heartbeat waveform feature to generate a corresponding additional measurement; and
preventing the weighting of the additional pre-selected heartbeat waveform feature in the statistical analysis.

9. (Previously presented) The method of claim 1 further comprising:
individualizing the measurements of the pre-selected heartbeat waveform features; and
calculating probabilities for the measurements.

10. (Previously presented) The method of claim 9, wherein individualizing the measurements comprises:

subtracting each corresponding measurement from an average value of the measurements to yield a centroid value for each pre-selected heartbeat waveform feature,
dividing each centroid value by a standard deviation to yield a quotient value,
determining a probability of the quotient value using a distribution calculation, and
selecting a threshold minimum probability.

11. (Previously presented) The method of claim 10, wherein calculating probabilities for the measurements comprises calculating a probability of divergence for each measurement using the quotient value.

12. (Previously presented) The method of claim 11, wherein calculating the probability of divergence using the quotient value includes using the quotient value in a T-distribution analysis.

13. (Previously presented) The method of claim 1, further comprising:
calculating an average for each of said pre-selected heartbeat waveform features from said measurements;
subtracting the average from each corresponding measurement to yield a centroid value;
calculating a standard deviation for each pre-selected heartbeat waveform feature;
dividing the corresponding centroid value by the standard deviation for each pre-selected heartbeat waveform feature; and
calculating a probability of divergence for each measurement corresponding to each pre-selected heartbeat waveform feature.

14. (Previously presented) The method of claim 13 further comprising:
for each electronic heartbeat signal, measuring an additional pre-selected heartbeat waveform feature to generate a corresponding additional measurement; and
preventing the weighting of the additional pre-selected heartbeat waveform feature in the statistical analysis.

15. (Cancelled)

16. (Previously presented) The method of claim 1, wherein the pre-selected heartbeat waveform features include univariate features of a heartbeat waveform.

17. (Previously presented) The method of claim 16, wherein the pre-selected heartbeat waveform features include multivariate features of a heartbeat waveform.

18. (Previously presented) The method of claim 1, wherein a pre-selected heartbeat waveform feature is a position of a dicrotic notch.

19. (Previously presented) The method of claim 1, wherein a pre-selected heartbeat waveform feature is a difference between two peak pressure amplitudes.

20. (Previously presented) The method of claim 1, wherein a pre-selected heartbeat waveform feature is a difference between two peak pressure change rates.

21. (Previously presented) The method of claim 1, wherein a pre-selected heartbeat waveform feature reflects how far a dicrotic notch is from a zero point.

22. (Previously presented) The method of claim 1, wherein a pre-selected heartbeat waveform feature is an up slope of a maximum peak pressure.

23. (Previously presented) The method of claim 1, wherein a pre-selected heartbeat waveform feature is a down slope of a maximum peak pressure.

24. (Previously presented) The method of claim 1 further comprising:
establishing a threshold probability value for each pre-selected heartbeat waveform feature, wherein the threshold value reflects a desired consistency and selectivity.

25. (Previously presented) The computer readable storage medium of claim 2, wherein said method further comprises:
individualizing the measurements of the pre-selected heartbeat waveform features, and
calculating probabilities for the measurements.

26. (Previously presented) The computer readable storage medium of claim 25, wherein individualizing the measurements comprises:
for each pre-selected heartbeat waveform feature, subtracting each corresponding measurement from an average value of the measurements to yield a centroid value,
dividing each centroid value by a standard deviation to yield a quotient value,
determining a probability of the quotient value using a distribution calculation, and
selecting a threshold minimum probability.

27. (Previously presented) The computer readable storage medium of claim 26, wherein calculating probabilities for the measurements comprises calculating a probability of divergence for each measurement using the quotient value.

28. (Previously presented) The computer readable storage medium of claim 27, wherein calculating the probability of divergence using the quotient value includes using the quotient value in a T-distribution analysis.

29. (Previously presented) The computer readable storage medium of claim 2, wherein said method further comprises:

calculating an average for each of said pre-selected heartbeat waveform features from said measurements;

subtracting the average from each corresponding measurement to yield a centroid value;

calculating a standard deviation for each pre-selected heartbeat waveform feature;

dividing the corresponding centroid value by the standard deviation for each pre-selected heartbeat waveform feature; and

calculating a probability of divergence for each measurement corresponding to each pre-selected heartbeat waveform feature.

30. (Previously presented) The computer readable storage medium of claim 2, wherein said method further comprises authenticating an individual based on the weighted pre-selected heartbeat waveform features.

31. (Previously presented) The computer readable storage medium of claim 2, wherein the pre-selected heartbeat waveform features include univariate features of a heartbeat waveform.

32. (Previously presented) The computer readable storage medium of claim 31, wherein the pre-selected heartbeat waveform features include multivariate features of a heartbeat waveform.

33. (Previously presented) The computer readable storage medium of claim 2, wherein a pre-selected heartbeat waveform feature is a position of a dicrotic notch.

34. (Previously presented) The computer readable storage medium of claim 2, wherein a pre-selected heartbeat waveform feature is a difference between two peak pressure amplitudes.

35. (Previously presented) The computer readable storage medium of claim 2, wherein a pre-selected heartbeat waveform feature is a difference between two peak pressure change rates.

36. (Previously presented) The computer readable storage medium of claim 2, wherein a pre-selected heartbeat waveform feature reflects how far a dicrotic notch is from a zero point.

37. (Previously presented) The computer readable storage medium of claim 2, wherein a pre-selected heartbeat waveform feature is an up slope of a maximum peak pressure.

38. (Previously presented) The computer readable storage medium of claim 2, wherein a pre-selected heartbeat waveform feature is a down slope of a maximum peak pressure.

39. (Previously presented) The computer readable storage medium of claim 2, wherein said method further comprises:

establishing a threshold probability value for each pre-selected heartbeat waveform feature, wherein the threshold value reflects a desired consistency and selectivity.

40. (Previously presented) The computer readable storage medium of claim 2, wherein said method further comprises:

measuring an additional pre-selected heartbeat waveform feature to generate a corresponding additional measurement for each electronic heartbeat signal; and

preventing the weighting of the additional pre-selected heartbeat waveform feature in the statistical analysis.